ELECTRICAL REVIEW

[ILLUSTRATED]

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Exhibits of the United States Electric Lighting Company and Mr. Weston at the International Electric Exhibition, at Philadelphia.

The extensive exhibits made by the United States Electric Lighting Company and the personal exhibit of Mr. Edward Weston, its electrician, formed one of the most interesting and attractive features of the late electrical exhibition at Philadelphia.

These exhibits occupied four large spaces in different parts of the exhibition building and composed a great variety of apparatus for arc lighting, incandescent lighting, electrical transmission of power, electro plating and similar applications of electricity.

In a large triangular space near the main entrance the United States Company made a general display of its apparatus, which is illustrated by the cut on this page. Another space at the left of that shown in the cut was devoted to the numerous fittings and fixtures used in the incandescent system such as chandeliers and brackets, switches, safety devices, lamp holders, appliances for wiring, lamp posts for street lighting and the like.

Mr. Weston's personal exhibit occupied a large pavilion near the fountain in the main building, and attracted a very large amount of attention not only from the general public who were interested merely in seeing the sights of the exhibition, but from the large number of scientific men who visited the exhibition to study the latest developments in electrical science.

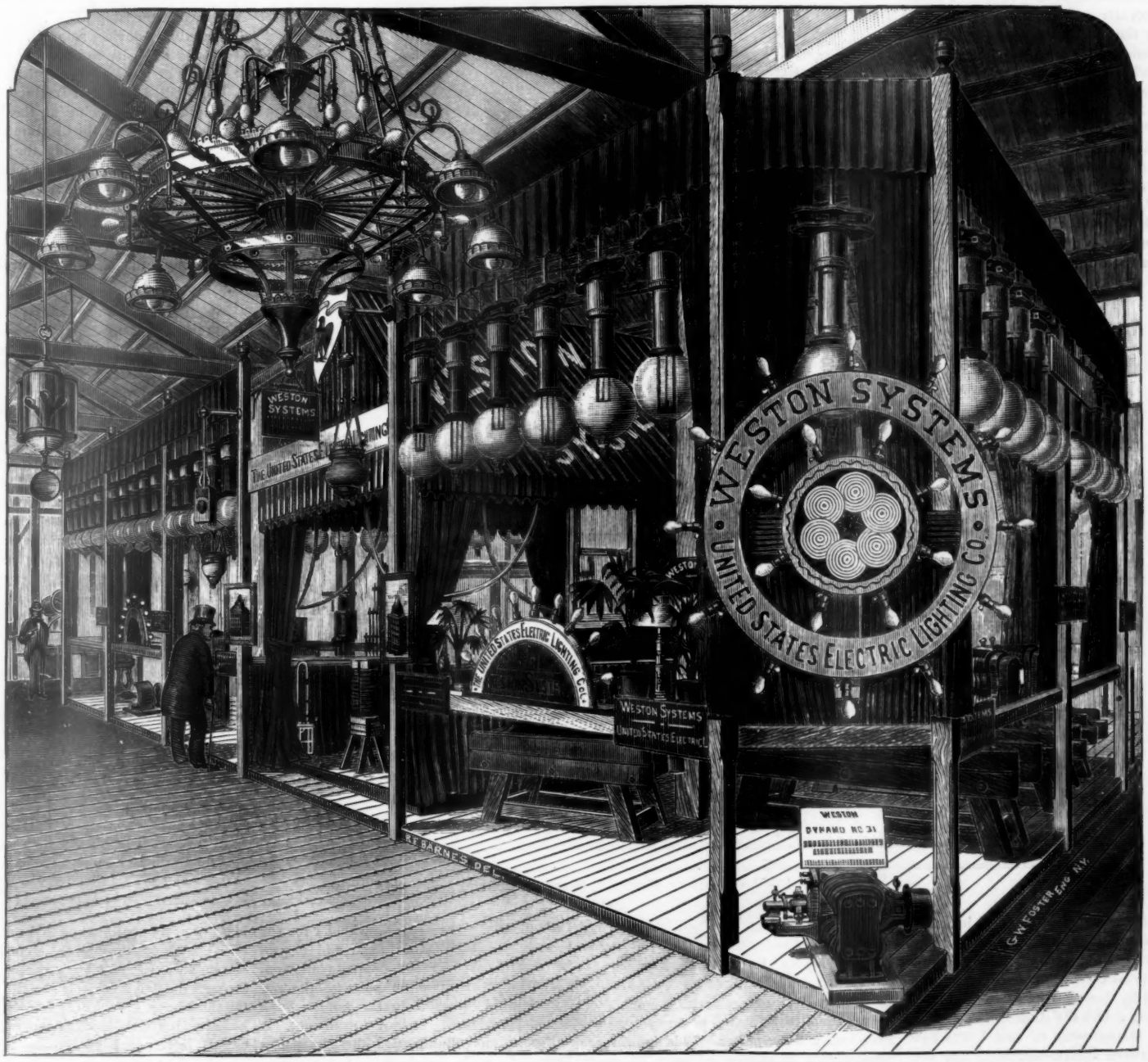
This exhibit was devoted mainly to the instruments and appliances used by Mr. Weston in his laboratory work, and to illustrating the processes of manufacture and details of construction of the apparatus of which he is the inventor; and it was admirably arranged for that purpose. The manufacture of incandescent lamps was illustrated in detail.

Tamidine, the new material from which the now familiar corrugated filaments of the Weston incandescent lamps are made, was shown in its various stages of manufacture and attracted much attention. Hydro-carbon treatment or the deposition of carbon on the loops from a hydro-carbon gas for the purpose of rendering them homogeneous and equalizing their resistance, was shown in actual operation as were also the exhaustion of air from the globes, and other processes used in making and testing the lamps.

Armatures and commutators for the dynamos, automatic regulators, lamp sockets, switches, safety devices, appliances for wireing the feeding mechanism of arc lamps and other parts of the apparatus were carefully dissected and exhibited in convenient form to show details of construction, which it is difficult to examine in the completed apparatus.

The electrical transmission of power was illustrated by motors driving heavy machinery and pumping water for a miniature Niagara.

One of the most interesting features of this exhibit was a fine collection of instruments used by Mr. Weston in his laboratory



EXHIBITS OF THE UNITED STATES ELECTRIC LIGHTING COMPANY AND MR. WESTON AT THE INTERNATIONAL ELECTRICAL EXHIBITION, PHILADELPHIA.

work for the absolute measurement of electrical quantities, and for photometrical work. Many of these were designed by Mr. Weston and constructed by the company.

On the north side of the main building and a little below the fountain the company exhibited a model central station for lighting, which served to illustrate the commercial operation of a good sized plant. In this station in which some fifteen dynamos for arc and incandescent lighting and the transmission of power were running, current was supplied to the numerous arc and incandescent lights of the Weston systems which were scattered throughout the building and to the electric motors in operation in Mr. Weston's space. Here could be observed the practical operation of Weston dynamo machines of different types, working under a variety of conditions, automatic regulators, current and potential indicators, manual and automatic switches and all the numerous accessory devices necessary for a complete lighting station.

In addition to the Weston arc system and the Weston incandescent system with which readers of the REVIEW are already familiar, the United States Company exhibited a new system recently perfected by Mr. Weston, involving the use of incandescent lamps of high illuminating power which formed the most novel and interesting feature of this company's exhibit, and we may fairly say the most interesting scientific feature of the entire exhibition.

These lamps of 125 and 300 candle-power, here exhibited for the first time, were distributed throughout a large portion of the exhibition building and were used for practically illuminating nearly one quarter of its ground space during the whole time of the exhibition.

That Mr. Weston has overcome these difficulties in a very satisfactory manner is attested by the fact that a considerable number of his large incandescent lamps have been in commercial use for some months past and have given excellent results.

The Weston 125 candle lamp, with its socket or holder, is illustrated in Fig. 2, the cut being two-thirds the actual size of the lamps. The carbon filament is 12 inches long and has a resistance cold of 125 ohms. For developing its normal illuminating power this lamp requires 160 volts and 2.3 amperes which represent an amount of energy equal to 368 watts, or something less than half a horse-power. This indicates a consumption of energy of only 2.9 watts per candle which is a very high efficiency.

The 300 candle-power lamp is of the same size and general appearance, the only difference being in the size of the carbon loop. It runs on the same electro-motive force but requires greater strength of current and uses about a horse-power of energy.

The platinum conductors leading into the globe are each composed of several strands of comparatively fine wire separately sealed into the glass and united outside and inside the globe. This ensures a more perfect seal than could be made with a single large conductor, and obviates all danger of the formation of cracks in the glass about the leading-in wires by inequality of expansion and contraction.

The base of the lamp consists of a cylindrical brass shell surrounding the neck of the globe and cemented to it. This shell has a wooden bottom piece upon which are secured two contact plates forming the terminals of the conductors leading to the carbon loop. The socket or holder for the lamp is also cylindrical in form and is provided with corresponding contact plates connected with the binding posts at the top. The lamp is secured in the holder by a bayonet joint catch, as shown in the cut.

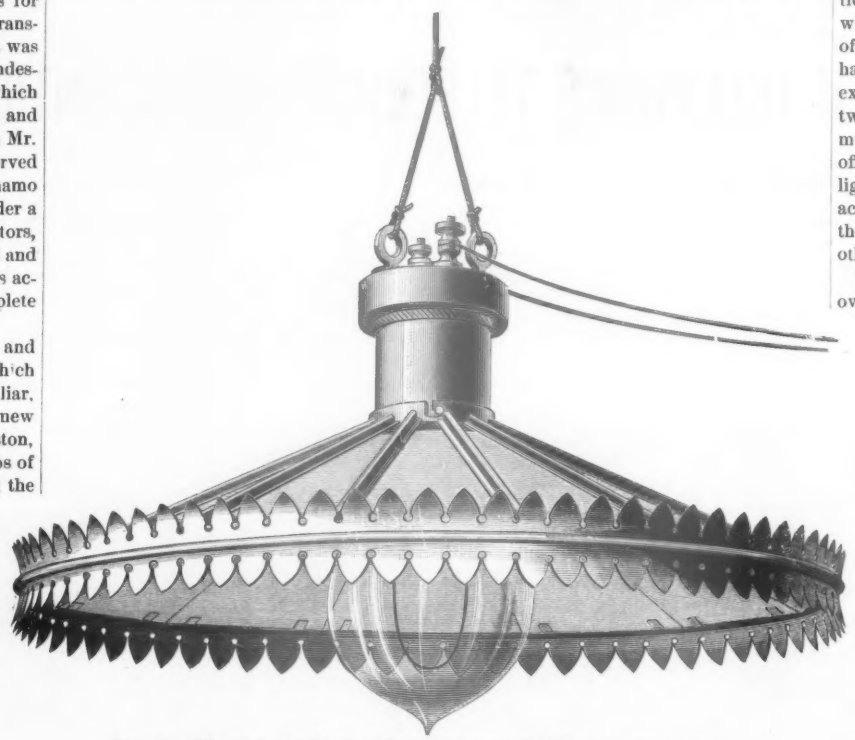


FIG. 3.—WESTON 125-CANDLE INCANDESCENT LAMP WITH REFLECTOR.

For interior illumination these lamps are provided with handsome brass-mounted porcelain reflectors of the form shown in Fig. 3. The most effective angle of the reflector for given heights of suspension of the lamp has been determined with great care, and the reflectors are not only ornamental but they add greatly to the actual efficiency of the system, by utilizing for useful illumination much of the light which would otherwise be wasted.

The high electro-motive force used with these lamps gives great facilities for economical distribution; and for isolated lighting or even central station work where the distances to be covered do not exceed 1,500 or 2,000 feet; the lamps are connected with the generator in simple parallel circuit or multiple arc, Mr. Weston having constructed a special line of dynamos wound for the required electromotive force of 160 volts.

To provide, however, for wider distribution and to utilize the dynamos and leads already in use for central station lighting, Mr. Weston has devised an ingenious modification of the multiple series system. Notwithstanding the many important advantages of multiple series distribution, this system has hitherto been used only to a very limited extent, and this has been due principally to two very serious disadvantages of ordinary multiple series: The lamps cannot be turned off and on independently, but must be lighted or extinguished in groups, and any accident to a lamp, such as the breaking of the carbon, involves the extinction of several other lamps as well.

The devices by which Mr. Weston has overcome these difficulties are shown in Figs. 4 and 5.

Referring to Fig. 4, which is a diagram of the connections for one branch containing a series of four lamps in a multiple series system it will be noticed that each of the lamps, L, L', etc., has certain auxiliary devices below it. It may perhaps be easier to understand the functions of those devices if their operation is studied after first tracing out the circuits. Commencing at the lower left hand corner of the diagram the branch circuit A, after leaving the main wire shown in the lower part of the cut, passes through the lower contact springs, a a, of the switch S, then on through the lamp L, to the binding post d, on the first cut-out box, and, after passing through the electro-magnet C, to the binding post e, continues on to the next switch S'. The circuit through the second lamp L', and its devices is identically the same as that through the first lamp as is also the circuit of the third lamp L^2. At the fourth lamp L^3, however, the switch S^3 is open, that is the circuit interrupted at the contact springs a^3, a^3. Just before reaching the switch S^3, a derivation from the branch circuit A, passes to the binding post c^3, on the last cut-out box. From c^3, the circuit is through the contact points i^3 k^3, (now connected by the armature of the electro-magnet C^3) and on through the resistance coil or rheostat R^3, (equal to the resistance of the lamp, when burning) to the binding post e^3. On leaving the binding post e^3, of the last cut-out box, the circuit passes to the binding post p, on the branch cut-out, thence through the contact points m, n, (now closed by armature o) to the other main wire.

Going back to the beginning of the branch

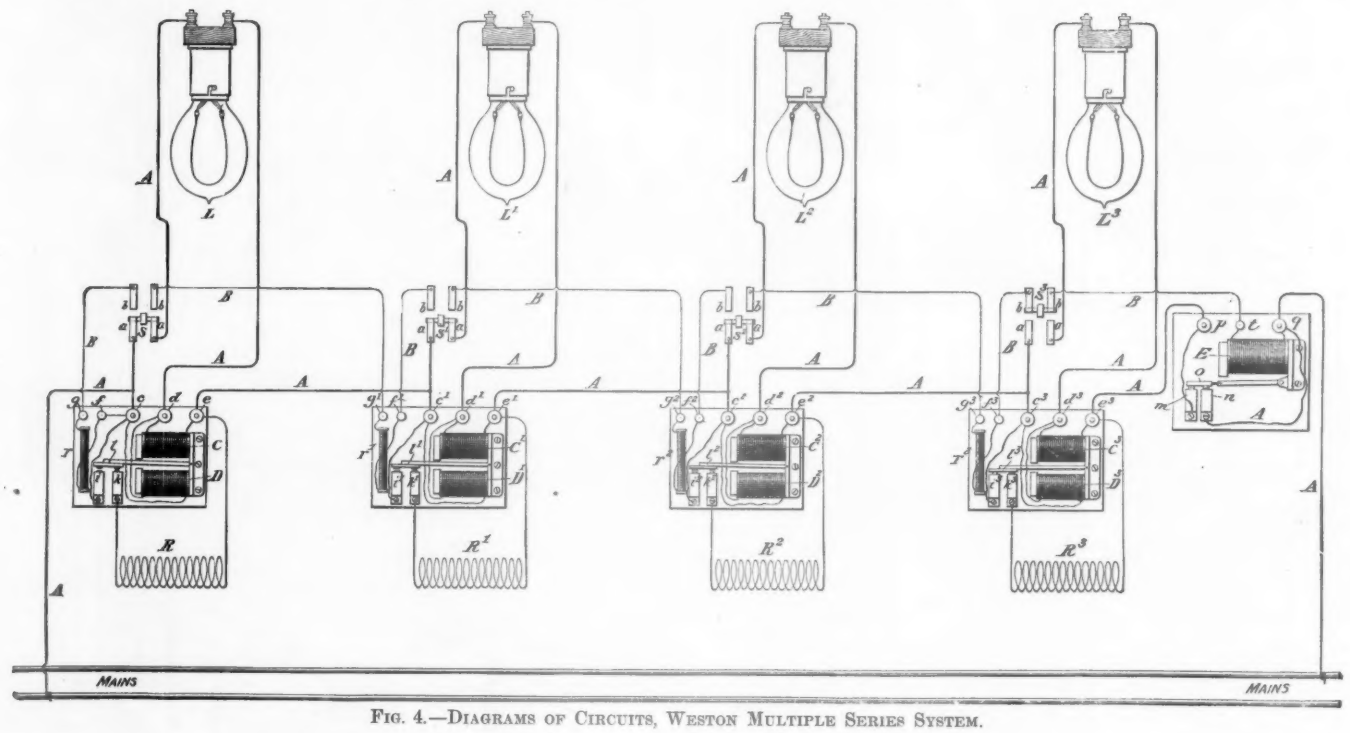


FIG. 4.—DIAGRAMS OF CIRCUITS, WESTON MULTIPLE SERIES SYSTEM.

The commercial advantages of incandescent lamps of high illuminating power—something between the arc light and the ordinary incandescent light—have long been recognized by those having to do with electric lighting; but the difficulties attendant upon the manufacture of such lamps have hitherto proved insurmountable. The construction of a large incandescent lamp suitable for commercial use, having an illuminating power say from eight to twenty times that of an ordinary incandescent lamp is not, as at first glance might appear, a simple question of enlargement of parts. The high electromotive force necessary for economical distribution, the greater strength of current required for the increased work, the large amount of heat generated and the size of the enclosing globe and of the wires leading into it, develop complicated phenomena which are destructive to the life of the lamp and which it has been found extremely difficult to eliminate.

circuit *A*, at the left of the diagram, it will be seen that there is a similar derivation to the binding post, *c*, on the first cut-out, passing on through the rheostat *R*, to binding post *c*, and others again to the binding posts c^1 and c^2 of the second and third rheostats, respectively. In fact the connections on each of the cut-out boxes are exactly alike, but the rheostats corresponding to the first three lamps are cut out of circuit at *i k*, *i' k'*, etc, by the electro-magnets *C*, *C'* and C^2 holding up their armatures.

A second circuit *B*, called the final cut-out circuit, starting from the beginning of branch wire *A*, at binding post *c*, – or, practically, from the main wire –passes through the high resistance coil *r*, (5,000 ohms) and from thence through the upper contact springs, *b*, *b*, of the switch *S*. From switch *S* the cut-out circuit continues on through the upper contacts of the remaining switches and through the high resistance coils attached to each box, passing from the last switch to binding post *t*, on the branch or final cut-out box and then through the electro-magnet *E* of the latter (also 5,000 ohms) to the binding post *q*, where it joins the branch wire *A*, on its way to the other main.

Having traced the circuits let us see what occurs when a current is sent through this series of lamps while the switches are in the position shown. It must be understood that when no current is passing the armatures of the cut-outs, actuated by gravity, are all down, closing the breaks *i k*, *i' k'*, etc., and completing the rheostat circuits *R R'*, etc., whilst the armature *o*, of the final cut-out closes the branch circuit at contacts *m n*. It will be seen that at each of the first three lamps, therefore, there are two paths for the current, viz: through the switch, lamp and cut-out magnet in one circuit, and through the contact points *i k*, and rheostat in the other. At the last lamp the first circuit is interrupted at the switch S^3, so that here there is but one path for the current, viz.: through rheostat R^3.

When a current traverses the branch circuit it divides equally between the two paths at each of the first three lamps, but when it attains a certain strength the electro-magnets *C C'*, etc., become energized sufficiently to raise their respective armatures and break the rheostat circuits, thus allowing the whole current to pass through the lamps. At the last cut-out, where the lamp circuit is interrupted at the switch, the whole current passes through the rheostat.

Should any one of the first three switches be turned off, or the lamps break, the armature of the corresponding cut-out magnet would fall, cut in the equivalent resistance of the rheostat and thus preserve the continuity and resistance of the circuit.

But to "make assurance doubly sure" a second electro magnet, *D D'*, etc., has been added to the cut-outs, which acts as a shunt around the lamp. It is wound with fine wire and its resistance is so adjusted that only a feeble current passes through its coil and it exerts but little attractive force on the armature, compared with that exerted by magnet *C*, with the normal electro-motive force at the terminals of the lamp. But when a lamp breaks, even if the broken loop tends to form an arc, as sometimes happens, and thus preserve the circuit, the potential at the terminals of the lamps rises and forces sufficient current through the shunt magnet to cause it to pull down the armature, thus completing the circuit through the rheostat. In practice this operates so quickly that hardly a flicker is observed in the remaining lamps. If a switch is closed—as, for instance, switch S^3, the armature 1^3, is raised, the rheostat circuit broken at the contact points, and the lamp thrown in circuit.

When a lamp is cut out it is evident that just as much energy is being consumed in the substituted rheostat as would be consumed in the lamp if it were burning. This waste cannot be entirely avoided in the multiple series system, but we now come to the function of the cut-out circuit, which is to reduce this waste of energy to a minimum by preventing it altogether in any branch in which all the lamps are cut out. It will be seen from the diagram that when the branch circuit is broken at a switch, the final cut-out circuit is at the same time closed at that switch. The peculiar form of switch used in connection with the multiple series system is shown in Fig. 6. Fig. 7 is another view of the same with its ornamental brass cover on. There are two circuits through this switch and when the key is turned so as to close one of the circuits, the other circuit is left open and *vice versa*. The connections of the switch are shown in the diagram Fig. 4, and the actual mechanism in Fig. 6. The pin shown in the center Fig. 6, is a mere bridge piece bridging over the break in the circuit between the contact springs at one side or the other. It is moved by the key through a cam movement so arranged as to give it a sudden throw on opening the circuit and thus prevent spark.

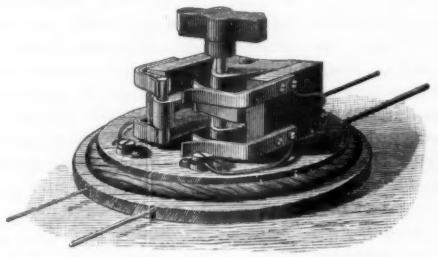


FIG. 6.—WESTON MULTIPLE SERIES SWITCH.

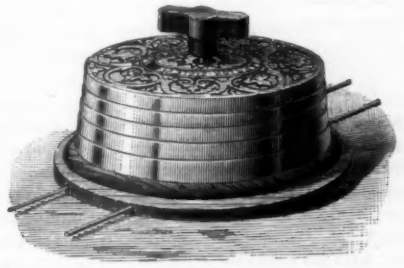


FIG. 7.—WESTON MULTIPLE SERIES SWITCH.

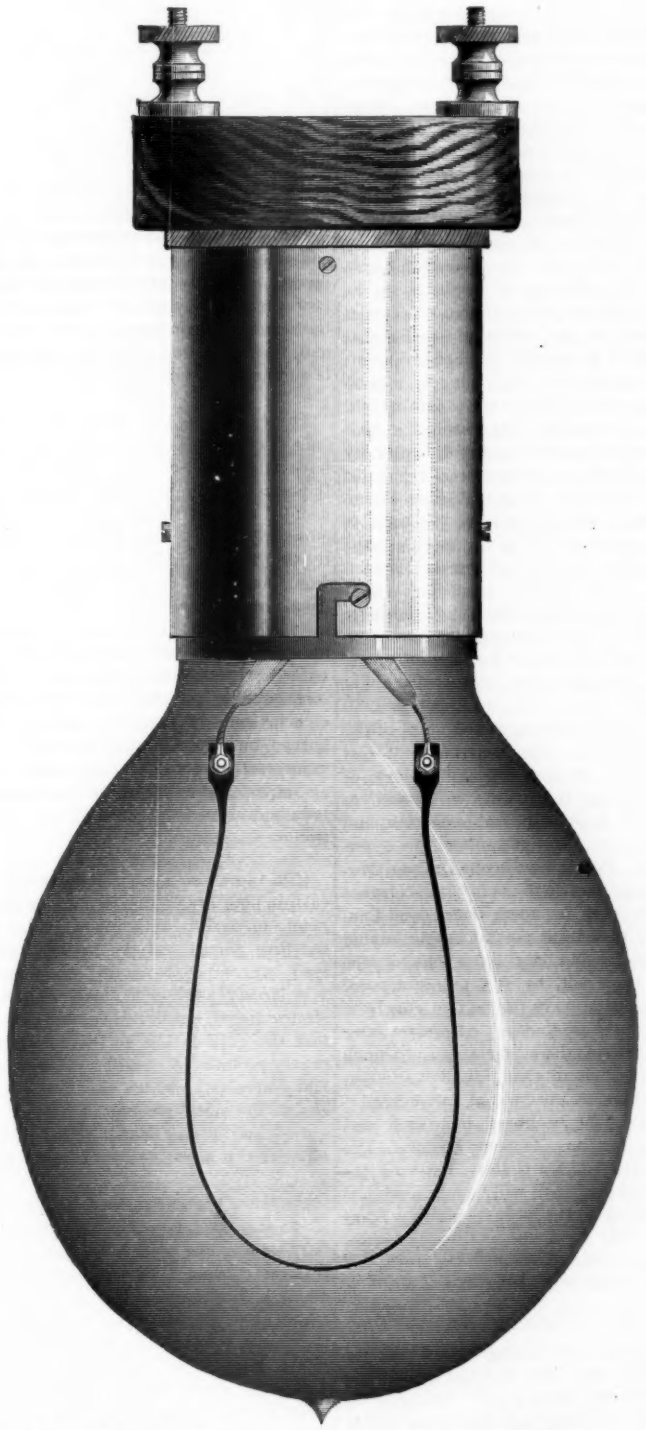


FIG. 2.—WESTON 125-CANDLE INCANDESCENT LAMP, WITH HOLDER. (Two-thirds Actual Size.)

FIG. 8—STREET LAMP POST FOR WESTON'S INCANDESCENT LAMP.

Now as there is a break or interruption in the cut-out circuit at each switch, it is evident that this circuit cannot be completed until all the lamps in a series are turned off at the switches. When this is done the circuit is completed through the final cut-out magnet, which, therefore, attracts its armature and breaks the branch circuit at contacts *m n*. The cut-out circuit consisting of the four resistance coils, and the final cut-out magnet, each having 5,000 ohms resistance, has, therefore, a total resistance of 25,000 ohms. As the energy consumed in a circuit is equal to $\frac{E^2}{R}$ watts, and the total electromotive force in this case is 640 volts, the energy consumed in the cut-out circuit when a series of four lamps is cut out, is only 16 watts, a practically infinitesimal quantity.

The current in the cut-out circuit when complete is only 0.026 ampere, and therefore an exceedingly small conductor may be used. In practice double strand insulated conductors composed of one No. 12 and one No. 20 (B. & S. gauge) copper wire, are employed for the branch and cut-out circuits. Thus only the labor of running on wire from lamp

(*Concluded on page 9.*)

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We invite correspondence from Electricians, Inventors and the Telegraph and Telephone fraternity on matters pertaining to electrical and scientific subjects, and all facts of special interest in connection therewith.

We extend to manufacturers of electrical apparatus an invitation to send to this office any and all facts concerning their business which will be of interest to the public. We make no charge for publishing news.

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The telephone companies in Great Britain have at last made such favorable terms with the Postmaster-General that they feel warranted in promising their stockholders a dividend next quarter.

Electric lightning is scarcely as necessary for naval vessels as for passenger vessels, in which it seems to be an additional attraction to swell the list of passengers. It is recognized as a great convenience on war vessels, however. One objection to the use of common lamps is to the heat generated by them, and scarcely less objectionable is the accompanying smell, both of which are avoided by the use of the electric lights. Besides, it is a great comfort and convenience to have the ships so well and steadily lighted. The Trenton was the first American man-of-war that was lighted in that way, and, although the experiment was tried by some European nations before, the Trenton, when she left New York for the Asiatic station, was the best lighted naval ship afloat. She had 250 lights. It is intended, as an additional experiment, to light a few other vessels in the same way. The Omaha is to be fitted with 155 lights, and the new steel cruisers, the Boston and Atlanta, will have 210 each, while the Chicago will be lighted throughout with 300 lights.

EDITORIAL NOTES FROM BOSTON.

Since I wrote you a week ago there has been a good deal of further talk, in the papers and out of them, about a consolidation of the electric light companies in Boston. I cannot find that any very decided steps have been taken as yet by the parties in interest, but it is very certain that there has been some talking and a great deal of thinking. I have already explained that there are three companies here—the Brush, the Western, and the Merchants', the latter using the Thomson-Houston system. The Brush Company here has the franchise for Suffolk County, which is practically covered by Boston and Chelsea. The Weston Company is, by title, the New England Weston, and covers the territory which its name implies. The Merchants' Company has the Thomson-Houston franchise for the city of Boston, exclusive of East Boston, where the Thomson-Houston system is represented by the Union Electric Light and Power Company, the franchise including Chelsea and some adjoining territory, notably, Revere Beach, a popular seaside resort in the summer. Now, to consolidate these interests would require some cutting and trimming to make the various pieces fit in properly. No doubt the Brush franchise might be taken as a basis, and transferred bodily to a new company. Then the Weston might transfer to the same so much of its franchise as covered the same territory. The Merchants' might go in *en bloc*, and so much of the Union as covered East Boston, or the whole of it, for that matter, might be added. Everybody seems to be of opinion that the thing is a good thing to do, but a difficult one to accomplish. When an undertaking is approached in that spirit it is very certain to prove difficult. By mutual concessions and forbearance, it ought not to be able to get at the real value of the several properties which it is proposed to combine, and then divide the stock of the new companies among their present owners, *pro ra a.* If the job is undertaken as a *deal*, out of which somebody is to make immediate cash profit, it will not and ought not to succeed: but if it be a consolidation or absorption, pure and simple, values being either agreed upon or settled by disinterested arbitration, it can be accomplished successfully in a week's time. The importance of this grows out of the fact that the business of electric lighting is growing in Boston, in spite of the most stubborn, malevolent and stupid opposition ever encountered by a new enterprise. People who scoffed at the idea of ever using electric lights in their stores are actually begging for them to-day, and I am quite sure that I am not far out in saying that, even leaving city lights out of the question, there will be fifty per cent. more "arcs" in operation in Boston in a year from now than there are to-day. At present three companies divide the business, causing much duplication of circuits and no end of friction, to say nothing of unadmitted, but nevertheless actual, concessions of one kind and another to customers to secure business. The time for consolidation is *now*. Later on the difficulties attending it will be increased just in proportion as the business grows. Some day, and that soon, the parties concerned will get at it and accomplish the work, and then the wonder will be that it was not done long ago.

It is a matter of surprise to me that the shops do not offer more toys and novelties in which electricity plays a part. We often see such things described and illustrated in foreign journals, but somehow nobody seems to think it would pay to try the manufacture and sale of such things. As a business venture I feel certain that it would be remunerative because of its novelty, and as a means of education it would certainly be of value Electricity has *come to stay;* it is henceforth to do as great and varied service to mankind as steam, and the more familiar the rising generation can become with its principles the better it will be for them when they become men and women. People didn't hesitate to pay five dollars a piece for creeping dolls twenty years ago, and at a considerably earlier period I know of a certain boy who took immense delight in a mechanical bear that danced in a comically clumsy fashion. Now I have a notion that there is skill and ingenuity enough among the electrical fraternity to accomplish results by means of electricity, by the side of which those depending wholly on wheels, rods, cams and springs would appear crude and awkward. Certainly the field is there, and it is worth looking into. If this suggestion should prove of value to any one, he is heartily welcome to it. It is too late for service this year, but before another holiday season comes round it may possibly bear fruit.

The Massachusetts Electric Power Company has got about ready to begin operations on an extended scale. It has a large dynamo of the Daft pattern in position on the Merchants' Electric Light Station, and has run a circuit of very heavy insulated wires as far as State Street. Its intention is to sell power for driving small machinery, such as lathes, sewing machines, printing presses, etc. The practical question is the loss of power which it will experience. With a current of such low electro-motive force, it is likely to be large, but it is believed that it will not be fatally so. Considering the convenience of getting power in this way, without the need of engine, boilers, shafting or even belting, save to a very limited extent, the purchasers can afford to pay a high price per horse-power, especially as the amount of horse-power required by each is very small. The business of the company is in first-rate hands, and, now that a beginning has been made, it is sure to be pushed with vigor.

The exhibition has not grown in importance or completeness as rapidly as one could have wished. Still there have been some important additions. The United States' people, spurred thereto, no doubt, by the efforts put forth by the Edison Company and the fine display which have resulted therefrom, have sent on two hundred of their usual-sized incandescents, which are to be installed at once. Their large incandescents, of 125 candles each, continue to attract attention. I think they were unwise to hang them so high, and they were a little unfortunate in some of them, for quite a number burned out one evening, and could not be immediately replaced. They were evidently an imperfect lot, for those that have since been substituted for them have given no trouble whatever.

Hill, Clarke & Co., a well-known mechanical firm here, are putting in a 50-light Berstein plant, to be run by a gas engine, of which the firm named has the agency. In England, where gas is cheap, gas engines are very largely used as a source of power for electric lights, but in this country it is feared that the cost of gas to the consumer will prove prohibitive. Still, considering the many advantages which gas offers as against steam, the small amount of attendance required, etc., it may be that, in isolated plants especially, it might be used to advantage.

Professor Dolbear showed me his detached telephone, an interesting and—to the uninitiated—a startling piece of apparatus. It is a receiver connected by two insulated wires, about a yard long each, with a brass ball, whose chief office is that of a weight to keep them hanging down in a straight line. When this is held in the vicinity of a telephone wire over which talk is in progress, it is heard by induction, just as talk is heard by induction when two wires are side by side in the air. There is nothing wonderful or new about it, and no one appreciates the fact better than Professor Dolbear, but to read what some of the papers here say about it one would suppose that he had made a new and exceedingly valuable discovery.

This leads me to formulate a question which I have often asked myself. Inasmuch as every well regulated paper thinks it of importance to employ an art editor, a literary editor, a dramatic and musical critic, and a financial editor, each, by a polite and pleasant fiction, supposed to be fully equipped to discuss and determine all questions which may arise in his special department, will the time ever come when it will be thought wise to confide electrical matters to some one who has at least a smattering of electrical knowledge—some one, for instance, who knows the difference between insulation and induction. How little the average "art critic" has ever seen of real art, is a matter of common knowledge; how little familiarity the average "literary editor" has with anything deserving the name of "literature," is proverbial; how uniformly the average "financial editor" comes to grief when he goes into "the street" and acts upon the advice which he daily deals out to his unfortunate readers, hundreds of seedy suits and shocking hats attest—but each and every one of these are bright and shining experts in their several departments compared with the gentlemen who "prepare" the electrical "copy" for the average daily newspaper in this country. A thing may antedate Faraday—it may go back to Volta and Galvani—if *they* have never seen it or heard of it before, it is *new* and *important*. Their antics would be ludicrous if they were not pitiful!

The majority of persons likely to have any interest in the matter here are inclined to look with favor upon the plan proposed for a national convention of electric light companies. The suggestion is made that each send two delegates—one to represent the electrical and mechanical part of the company's affairs, and the other its "business end." The idea that all questions relating to the comparative value of systems should be barred, partly because agreement on such questions could not possibly be obtained, and partly because there is quite enough to talk about and discuss without them. All over this country, companies engaged in electric lighting are meeting with the same difficulties and inconveniences, and are overcoming them in one way and another. Now, on the principle that the sum of all men's experience is better than the experience of one man, even though he be the best informed and have the largest experience, it is clear that an inter-communication of ideas and experience in practical lighting cannot but do good. No man can claim to "know it all," and no man is so well informed that he cannot learn something from the experience of others. This relates as well to the practical as to the business side of experience. In the latter, while no man is to be expected to "give away" information that is really valuable and is exclusively his, there is very much that he can contribute without loss to himself and yet with benefit to all. It is to be remembered that it is for the interest of all engaged in the business to have it succeed generally, to have it become popular, to have the demand for it increase the country over. Any general public favor shown to the electric light as a means of street illumination, for instance, must benefit, more or less, if not immediate, in the not remote end, every electric lighting company in the country. One great passport to public favor is economy, and if, by the holding of such a convention, men learn to introduce little economies here and there, it may be just enough to change the balance in many cases from loss to profit. The public *worships success*, and a company that is doing a prosperous and dividend-paying business is far more likely to have a large demand for lights than one that is "scrubbing along" and barely making one hand wash the other. It does not seem as though so long a presentation of arguments as this ought to be necessary, but the fact is that man is, by nature, a jealous and suspicious animal, and that those are not likely to be wanting who will vainly imagine that if they attend such a convention or conference they will be led to give more than they receive, and benefit others without adequately helping themselves. My own experience leads me to the conclusion that such people very seldom have anything to impart which is really worth learning, and that they are seldom made tired by having information of any value pumped into them.

In further illustration of the point I am

seeking to make, let me say that I have seen not a few electric light stations, and talked with no end of electric light men. The former I have found uniformly interesting to see, and the latter invariably instructive to talk with. I never yet saw an electric light station in which I did not find some new and ingenious device or arrangement which I had never seen or heard of before; and I never talked with an electric light man from whom I did not learn something. I have always tried to give as much of a *quid pro quo* as I could, and my information, gained from experience and conversation, has enabled me to communicate some ideas which my hearers were good enough to pronounce valuable. I think that no electric light man could inspect the Brush station in Buffalo or in Minneapolis, without getting some good ideas, and I am equally certain that no one could look through the Merchants' station in this city without admiring the admirable economy in space and power, and the convenience which the arrangement of engines and dynamos secures. And yet, in talking with the officers of these three companies, I find that if they had the work to do over again they would, on the basis of their experience, make important changes. Now the arrangement of stations can be shown by plans and drawings, but the result of experience can only be obtained by bringing men face to face It is this that a convention would accomplish.

I find that the superintendents of the various gas-light companies doing business in and about Boston—every suburban city and town has its gas works—hold weekly meetings in Boston, at which their differences are sunk, and the points upon which they are united in a common interest are brought prominently to the front. Chief among these is their opposition to electric lighting, and no stone is left unturned to arouse public distrust of, and public and municipal opposition to, the introduction and use of electric lights. The policy is a stupid one, and there are exceptional sporadic cases of gas-men who are smart enough to lay prejudice aside, and see that the more the "average eye" is keyed up to need more light by the use of "arcs" in the streets, and in stores and public buildings, the more gas is going to be burned in houses and in offices, and that, where one burner was once thought an ample sufficiency, two are considered none too much now. But, as I said, these men are the exception, and so the great bulk of gas men oppose the electric light at every turn, and take weekly counsel together to see how they can fight and oppose it, and, if possible, bring discredit and odium upon those who are engaged in introducing it.

We have here in Boston a notable case of a man's "biting off his nose to spite his face." Mr. Harvey D. Parker, lately deceased, was the proprietor of the well-known Parker House, in which he made a fortune. A good deal of his surplus went into gas stock, and at the time of his death he was a large holder. He looked upon the electric light—I say this on the basis of what he said to me personally—as an interloper, an intruder, and he was satisfied that there was not an electric light in Boston that did not represent fraud in some way or another. Naturally, he would have none of it in his house, which was and is exclusively lighted by gas. What is the result? All last summer, when the dining rooms of the other hotels in the city were illuminated by the bright, cool rays of electric lights, chiefly arcs, but in one notable case incandescents, the dining rooms at Parker's were hot, stuffy, and disagreeable with the sickly yellow glare of gas, spoiling the air, and covering the ceiling and hangings with impalpable soot. They were not overcrowded, I noticed, and it seemed to me that possibly the discomfort which the gas occasioned had something to do with the lack of patronage. One of these days the young men who have succeeded Mr. Parker as proprietors will wake up to the idea that, if they want to protect their property from slow but steady deterioration, make their rooms attractive, and do something for the comfort of their guests, the electric light will help them, and that they cannot afford to let the prejudice of the excellent old gentlemen who has "gone before" to stand in their way.

Strange as it may seem, I have never seen or heard from Mr. Adams ("Hammer") since I wrote that short note which you published concerning his having a hand in approving the Dakota purchase. I am the more surprised at this, because at the same time I wrote him a personal letter, expressing the general idea that it did not seem to me to be quite the square thing for him to come to me and, by suppressing an important part of the letter, try to lead me into making an exonerating statement, which would not stand the test of comparison with the record. But, as I said, he has never answered the letter. This is discourteous, but I fancy the poor man is "tired." It is trying for a man whose vocation it is to handle "scissors and needles, nails and knives," to tackle those larger matters in which the world is engaged. Poor Hammer! If he could "wheedle a knife or needle, why not a" board of directors? In the words of Gilbert's song about the "hardware shop:"

> "The kettles boiled with rage, 'tis said,
> And every nail went off its head,
> And hither and thither began to roam,
> Till a *Hammer* came up and *drove them home*."

And so the stupid antics of Hammer drove the board to a little common-sense consideration of the case.

By the way, I understand that the Erie Board did me the honor to read my letter from Minneapolis in solemn session, that it was discussed—some of them omitted the "dis"—at length, and then, severally and collectively, they voted unanimously that they didn't want another word said about it. But somehow I like to have the *last* word myself, and, now that I have said it, not another shall be heard from me on the subject, unless.——

Erie matters are working along more smoothly, although the stock shows little or no improvement. It has three valuable franchises, earns a good deal of money, and will, I believe, get back to a dividend paying basis. It must be remembered that the stock was marketed at 60, and that none was ever sold at a figure materially above that, so that the present price, say 20, is not *quite* so bad as it looks. It looks as though the directors were now bending their energies to putting the property in good shape, and devoting their endeavors to the interests of the stockholders. If this course be pursued, and they do not scare up any more mare's nests, I believe things will look materially better a year from now than they do to-day.

The New England Telephone is in first rate shape. A great deal of reconstruction and repair has been done during the summer and fall, and Col. Keller, the new Acting General Manager, finds a company with a great number of well-equipped exchanges doing a good business. He is hardly warm in the saddle as yet, but he is evidently a man of vigor and snap, and will very soon "get the hang of the barn." I judge that it is the intention of the American Bell Company, which owns a controlling interest in the New England Company, to spare neither money nor endeavor to make it all that telephone men can desire or the public demand, and to put its organization and equipment on a thorough and substantial basis.

This is the last issue of the REVIEW for the year that is closing. Next week will usher in 1885, and we shall be wise if we welcome it, for, whether we will or no, we have got to receive it. The year 1884 has not been, in a business way, all that one could have wished, and as it passes out there are decided signs of commercial gloom. But the darker the sky the nearer the dawn! Let us hope that '85 will bring it, and that it will prove, to one and all, A HAPPY NEW YEAR.

Electricity and the Ballot.

While the ballot must ever remain the foundation of the republic, and its increased freedom and purity the salvation of the people, the rapid advent of electricity into the economy of modern living plainly indicates that the ballot box "must go." It is a bulky, inconvenient accessory to elections, manipulated as it is by thousands of citizens, both honest and dishonest, accurate men and blunderers. It is frequently "stuffed;" often robbed of its rightful contents and bogus ballots placed in it, as in Chicago; used as a "sleeper" or absolute dummy, as in Virginia; and from its recesses come tissues of falsehood, as in South Carolina. All this must eventually be done away with. Electricity will solve the problem for us, and the ballot box will be stowed away in the attic of a slow and incomplete civilization. This may be years from now, but possibly not a great many years. The telephone, unknown in 1870, is now in such common use as to be the greatest blessing and nuisance in our daily business intercourse. Who knows but electricity will be applied to the franchise, quicken it with a new life and throw a new mantle of purity over it. In fifty years from now we shall, in all probability, vote by electricity; our choice will be recorded in the office of Secretary of State the instant it is made, and the after-exercise of the ballot counter will be dispensed with, all his duties being performed by accurate electrical machinery. For instance: At each polling place will be found a keyboard with electric buttons, a button for each of the Blaines and Clevelands, Harrisons and Wallers of that good future day, these buttons connecting with a wire to the office of the Secretary of State. The voter will call his name, and the gentlemanly citizen who has charge of the check list will say, "Vote Mr. Smith," and he will press the button which bears the name of his favorite candidate; the instant it is done, a click and a record in the central office, the general convergence of wires for the whole State, and all will be over. When the polls are closed the recording machinery will disclose at a glance the number of votes each candidate has received, and the successful party can "celebrate" and get to bed by twenty minutes past nine, there to sleep the sleep of the just, tickled to death at the result. It may be objected that the temptation of the average voter to press the electric button twice in favor of his candidate will be equal to the present temptation to deposit two ballots in our degenerate days; but let the machinery be so adjusted that a second press on the button would burn him to a cinder by a current of electricity, or knock him endwise out of the polling place, into the gutter, and he would hardly attempt it a second time. The scheme of electric voting is one that will attract the attention of the inventor and the ballot reformer of the future; and it will upset all the patent "coffee mill" self-registering ballot boxes that exist in the brains of men who see a fortune ahead by forcing them upon an unwilling public at twenty-five or thirty dollars a piece. Here's hoping that we shall all live to see the electric current galvanize the ballot into absolute purity.

Advantages of Compound Dynamos.

With reference to the arguments against compound dynamos, put forth by the *Zeitschrift fur Elektrotechnik*, and reproduced in the London *Electrician* of 29th November, Herr Uppenborn says that they only have the appearance of being warranted. Thus, it it neither necessary nor possible to attain constancy within 1 per cent. In practice, incandescent lamps constructed for a difference of potential of 100 volts require tensions differing 5 per cent. for being raised to the same temperature. The manufacture of these lamps has not yet attained so high a degree of perfection that such precision may be relied upon. The manufacturer does not employ the same measuring instrument as the engineer charged with the installation, and differences of 4 and 5 per cent. may readily be admitted. Besides, laboratory instruments could not well be put into the hands of a workman. Nor is it true that a compound, for an increase of intensity of 20 per cent., manifests a difference of potential of 3 per cent. A Schuckert machine only shows a variation of 3 per cent., the intensity varying from zero to the maximum. If so satisfactory a result cannot be attained generally, it is at least possible to approach it very nearly. The heating of the machine is not of great importance. Let it be so with a compound, of which the induced has a resistance of 0.31 ohm up to 28 amperes. The resistance of copper increases 0.4 per cent. for every centigrade degree. Let a deviation of temperature be supposed of 20° C., which corresponds with an increased resistance of 8 per cent., or 0.025 ohm. The product of the maximum intensity, 28 amperes by 0.25 ohm, gives 0.7 volt. The inductors of the compounds are, besides, so constructed as to have slight resistance and to heat very little, so that the influence of heating is infinitesimal. A shunt dynamo, *ceteris paribus*, cannot present the same constancy as a compound; and the statement that the difference of potential at the terminals of an Edison dynamo is only 1 per cent. for an increased intensity of 50 per cent. must be taken *cum grano salis*. But supposing this strictly true, it only proves that the dimensions of an Edison machine are quite abnormal. The inductors are excessively large with respect to the induced, especially in the original American type. The machines which gave the diagrams instanced are, on the other hand, almost of the same dimensions, and it is rational to compare them. Now, in this case, the maximum production of the intensity by the difference of potential at the terminals is obtained when $R = 26$ ohms, and from 30 to 40 ohms the tension increases about 25 per cent. This shows conclusively that it is more advantageous to construct a compound dynamo with an equal quantity of copper, because, under however bad conditions such a machine may be put down, it will never show differences of 20 per cent.

The advance in Bell Telephone may be due to the digestion by stockholders of Judge Wallace's decision. Some people have thought our position against the Drawbaugh claim for two years past rather severe, but here is what the Court finds:

"Where a witness falsifies a fact in respect to which he cannot be presumed liable to mistake, courts are bound, "upon principles of law, morality, and justice, to apply the maxim *falsus in uno, falsus in omnibus*." (The Trinidad, 7 Wheat. 283). Drawbaugh could not be mistaken in asserting that it was his poverty which prevented him from caveating or patenting his invention. He was not led to the assertion inadvertently. Those with whom he is associated in the defence understood fully, and so did he, that the fact that a professional inventor and patentee did not go to the Patent office to secure an invention like the telephone for ten years after it had been completed and demonstrated, was almost conclusive against the theory that he had made the invention; and that unless this presumption could be parried, no court would credit his story. The theory of constraining poverty was therefore formulated in the answer, elaborately fortified by witnesses, and testified to by Drawbaugh. It is overthrown by a few plain, indisputable facts, and Drawbaugh's veracity falls with it."

Judge Wallace also performs a public service in pointing out just what Drawbaugh did have by which a hundred ignorant witnesses could be deceived in so much that the gigantic conspiracy could be built upon their testimony and flourish before the courts for some years. Drawbaugh had an "apparatus to send messages by means of an alphabet founded upon difference of sounds." He never expected to send articulate speech over a magnetized wire, but he believed that an alphabet could be arranged after the manner of the musical scale, and that messages could be understood by the variations of tone and pitch.

Telephonic News

*** Stop a minute, now, and look back a few years! How long ago is it that many of us ever thought of sitting down at the end of a wire and listening to the conversation of a friend even two or three miles away? The first that common people ever heard of the telephone was in 1876. The electric light has come into use within about the same period, and now the propelling of railway cars by electricity is under general consideration.

*** The Guatemala Telephone Company has been organized in San Francisco, with a cash capital of $25,000, to operate the telephone business under a Government concession for Guatemala, Central America, and under license from the Inter-Continental Telephone Company and sub-contract with Messrs. Wendell & Phillips, of Boston, who control the Central American business. Mr. Samuel Hubbard, formerly in charge of the Bell telephone business in Honolulu, S. I., sails next week for Guatemala with 100 complete sets of Bell and Blake instruments and central office outfit to establish the system in that city and manage the company's affairs. One hundred subscribers are already engaged, and it is expected that two hundred subscribers will be secured and put in telephone connection in 1885. The officers of the company are: R. Toledo, president; H. C. Hyde, vice-president; and John Lloyd, secretary and treasurer.

*** The New England Telephone and Telegraph Company have just prepared a revised list of subscribers of the Worcester division, and the division connections are made with 1,490 subscribers, of which 1,141 are in Worcester County, as follows: Worcester, 816; Cherry Valley, 4; Holden, 2; Jeffersonville, 3; Leicester, 2; West Upton, 2; Upton, 1; Millbury, 13; Farnumsville, 1; Fisherville, 3; Sutton, 1; Shrewsbury, 5; Oakdale, 1; West Boylston, 2; Rutland, 2; Grafton, 2; North Grafton, 3; Oxford, 1; North Oxford, 1; Milford, 59; Hopedale, 6; Uxbridge, 2; East Douglas, 2; Spencer, 51; East Brookfield, 13; North Brookfield, 18; Oakham, 4; Barre, 4; Coldbrook, 1; Brookfield, 8; Webster, 25; Dudley, 2; West Dudley, 1; Southbridge, 39; Charlton City, 1; Charlton Depot, 1; Sturbridge, 2; Fiskdale, 3; Warren, 5; Westborough, 14; Northborough, 6; Southborough, 7; Fayville, 1; Princeton, 3; Sterling, 1; Bolton, 1; Lancaster, 11; South Lancaster, 1; Clinton, 62; The towns in the northern part of Worcester County form a part of another division. The subscribers in those towns are as follows: Winchendon, 28; Athol, 29; Phillipston, 1; Petersham, 1; Gardner, 60; Baldwinville, 16; Templeton, 6; East Templeton, 3; Otter River, 7; Westminster, 2.

.... The wedding-present business was done on the reverse plan by a man connected with the Western Union Company in Cincinnati. He distributed $1,000 among the messenger boys in honor of his wedding.

.... The cable between Senegal and France has been completed, and the first messages have passed expressing the devotion of the colony to the mother country, and a reciprocal feeling on the part of the latter.

.... The Western Union Company is said to propose a 10 per cent. reduction of pay as a Christmas present to its employes.

... For some time it has been rumored that the telegraph operators of the country at large are contemplating another strike. The recent memorable strike has, the operators as a body say, made them veterans. It was an experience they were unused to, and one, too, that has taught them the value of organization as an important factor in such a movement. Say the operators, as with one voice, "The Western Union makes prices, controls men, and holds its employes under its thumb. This big grasper of money and absorber of poolry paid toil must be brought to terms.

Telephoning at Sea.

ELECTRICAL PROJECTS FOR RENDERING OCEAN TRAVEL SAFE.

It may be said for electricity that the realization of its promises are often more extraordinary than what was at first expected. We believe that it can be distributed in large quantities by wire, and before realizing our expectations we discover that even more than this is possible and even practicable—we can box it up, disconnect the wire, and carry it around with us. It is, in fact, a constant surprise, and, as the best informed electricians have declared that we are not likely to discover of what force it is the expression, it is likely to continue to astonish.

There are two electrical projects under consideration just now, which, judging from past experiences, may not unreasonably be looked to for astonishing practical results in the future. The first is based upon a discovery due to Professor Graham Bell, that vessels on the high seas may hold telephonic communication with one another without connecting wires; and the other project has reference to a chain of light ships stretched across the Atlantic, and communicating with both America and Europe by means of a cable. In accordance with scriptural law, the first shall be considered last and the last first.

The project of lighting the Atlantic, or rather of lighting the steam lane between America and Europe, may be said to be founded upon two undisputed possibilities, *i.e.*, that a light ship will lie at anchor in a heavy sea without protection, and that electrical communication may readily be maintained between the two continents. It is proposed to utilize these already ascertained facts by not only marking out the track across the ocean, but affording at short intervals a safe refuge for the passengers and crews of disabled vessels, and a means of keeping the great fleet continually strung along this lane in daily communication with the shore. The line of light vessels would extend due east from the Banks of Newfoundland to the Irish coast; the vessels, ten in number, being distant the one from the other two hundred miles. Each of these vessels would ride behind a mushroom anchor, which permits of a vessel's swinging to her anchor when the tide serves without fouling it. Many a light ship, as we know, rides safely in as heavy seas as can be found on the broad ocean, beside taking their chances of going ashore on a rock-bound coast or drifting upon such death-dealing sands as Nantucket shoals and the like. So far as the extra length of cable required for these ocean light-ships is concerned, there need be no fear, for a light cable has been devised which permits of a ship's anchoring with two or three miles of water under her.

In accordance with the plan devised, these light ships should be electrically connected with a transatlantic cable, buoyed to the surface in their vicinity so as not to run the risk of being fouled by their anchors. In case a light vessel should break adrift, as light vessels will at times do, the cable should be cast off and connected up again when the ship has regained its proper position.

Let us see now what results might be looked for in the establishment of such a service. As is well known, the dangers of navigation during thick or foggy weather are as great now as they were a century or more ago. Marine architecture has been as good as revolutionized within the last two decades, the chances of disaster from fire and sinking have been greatly diminished, but the chances of collision have not been lessened. Indeed, the fact that great cumbersome steamships now dot the ocean, vessels that cannot be quickly turned, has served to make the danger of collision greater now than before. Innumerable systems of signaling have been devised and considered, but none have, as yet, been adopted, because none have been found which combined simplicity with efficiency, and the old and unreliable one is still in force, which requires sailing vessels to sound horns in thick weather and steamers to go at half speed and blow their whistles. The result is that, though the master of the vessel to leeward knows that another vessel is advancing toward him, he cannot always tell from what direction unless the wind is blowing directly from that advancing ship to his. Hence there is at all times a chance of disaster from collision, to say nothing of broken shafts, fires, and the like on the steamers and other and various descriptions of accidents on sailing vessels. Now, with the chain of light vessels as devised, there would at all times be a straight line of lights marking the shortest route across, and steamers, in order to avoid collision with each other, could leave this line on the port hand, sailing both east and west. Such a line would not be open to the same objection as has been urged against the so-called steamer lanes, because it would be so sharply defined as not to compel a vessel to go a long distance out of her course. As the light vessels would be numbered for identification by day, and carry lights differing the one from the other at night, such as steady lights, revolving lights, one-second flash, minute flash, and the like, they could be readily identified at night. For steamers this would insure the exact determination of their position in thick weather, when the sun, moon, and stars were invisible. For sailing vessels working against head winds, such known points would, of course, be invaluable, for the exact latitude and longitude of each light ship would be marked off on all ocean charts, and sailing vessels that had been beaten about by stress of weather could, when it cleared up, take a new and certain departure from one of these light ships.

Being only two hundred miles apart, no ship following their alignment could be more than one hundred miles away from a point of communication with the shore or a point of refuge for passengers or crew, should disaster befall. The progress of each ship, as it was sighted and signalled, should be recorded daily by cable at the expense of the company that owned her, and in case of disabled ships the nature of the accident could be signalled before the continued absence had caused any alarm. As it is now, the friends and relatives of passengers in a disabled ship must often wait for weeks before intelligence comes, and in the meantime know not if the vessel is lost or proceeding under sail by reason of accident to her machinery. In giving the position of stray icebergs and telegraphing approaching storms, the service of such a line would be likely to prove invaluable to the mariner.

Taking up now the project of telephoning between ships traversing the high seas, the results already obtained show that it is far from chimerical. Professor Bell has actually carried on a conversation in deep water between two boats, a mile and a quarter distant from each other, both vessels being under weigh and having no wire connection between them. From one of the boats one of the two terminals of a telephone was suspended over the bow, and the other allowed to trail over the stern. In the other boat there was a much similar arrangement, except that instead of a telephone it had aboard an electric battery and an apparatus for interrupting the current quickly; that is to say, at about the rate of one hundred times a second. As soon as the electric battery was put into connection with the water, the latter became charged with electricity, and only ceased to be in that condition when the circuit was interrupted, and this always resulted in the reception of a musical note that could be distinctly heard in the boat at a distance. When the interesting fact became apparent that a musical note could be transmitted through the water at the will of the operator, the project of telephoning between ships seemed as good as feasible, because then it was only a question of making a code of telephone signals. Professor Morse, as we know, first discovered that he could transmit a mechanical movement to a distance, electrically, and then set to work to utilize this movement in making dots and dashes, of which his entire alphabet is composed. In like manner, Professor Bell, when he found that, by interrupting the electric current connecting two ships, he could project a musical note across the intervening space, readily composed a code of electrical signals, by which every letter in the alphabet could be denoted, and thus was enabled to transmit messages by sound.

* * * * *

It may be inferred from what was said above, if we judge from past experience with electrical projects in their incipiency, it is not unreasonable to suppose that the discovery, as so far developed, is only the germ of a something which in time, and with continued investigation, will lead to results the importance of which we can now scarcely form an idea of. Indeed, in time, that part of the discovery which relates to electrical communication between ships on the high seas may prove the least important of a series of other discoveries founded upon the same principle.

The Serson-Kauffer Batteries.

The Serson-Kauffer Electric Battery Company, whose office is at 51 State Street, Boston, is now offering several styles of battery, suited to different uses. The first is a (Fig. 1) patent gravity battery, which differs from the ordinary gravity battery in the fact that the zinc is in a suspended porous cup. It works on closed circuit for fire alarms, Morse, main and local lines. The city of Boston, and many other cities, have recognized the merits of this battery, and the city of Boston has used in its Fire Alarm Department a circuit of 58 cells, which ran from November, 1882, to November, 1883, with no renewal of material, and with nothing done to it except to add water to take the place of evaporation. The consumption of material during the whole time was less than 4 lbs. of sulphate of copper, and less than 2 lbs. of zinc per cell. The old gravity, in the same time, and doing the same work, consumed 10 lbs. of

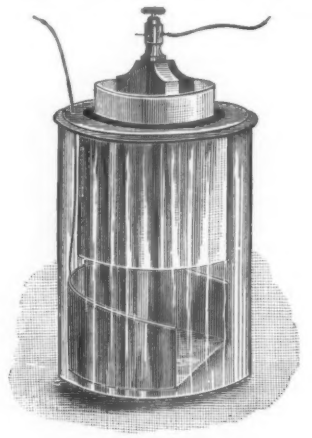


FIG. 1.

sulphate of copper and 10 lbs. of zinc per cell.

The following letter, from Prof. A. E. Dolbear, of Tuft's College, speaks for itself; and his opinion that the battery "is able to do continuous work for months without attention" is amply verified by experience in the Boston Fire Alarm Department and by others.

SIR: I have examined the call of the S. & K. Co., which was sent to me, and think it to be the best constant cell with which I am acquainted. Its electromotive force and internal resistance are about the same as those of a very good Daniell cell, but on account of the mechanical arrangement of the parts it is not subject to such troubles as beset a gravity cell. The porous cell for the zinc secures the latter from the deposition of copper, and keeps it clean and available for service so long as there is any.

The covering not only prevents evaporation, but prevents the creeping of the zinc sulphate to the outside of the cell, and the cell therefore keeps clean and does not need watching.

As for its constancy, there is no doubt about its being able to do continuous work for months without attention. In my opinion, it will displace most of the gravity cells so much used in telegraph work, and is to be recommended to anybody who wants a clean, durable and economical cell.

A. E. DOLBEAR.

No. 70 Washington St. Boston, Jan. 31st, 1883.

The large carbon battery, Fig. 2, is for

open circuit work, such as gold and stock instruments. It consists of a double suspended cell, the inner one, in which the zinc rests, being perforated with large holes. Water surrounds the zinc, and fills both cells. Outside the outer cell is a piece of carbon and bichromate of potash in solution. Four cells of this battery were tested on a circuit of the Gold and Stock Telegraph, in

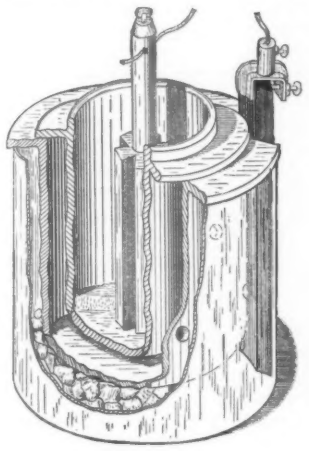


FIG. 2.

the office of the Western Union Company, in Boston, and ran four months without being taken down or cleaned, and with only a renewal of the fluid in the inside porous cup once in three weeks, and kept up to the full standard of strength the whole time. The old carbon batteries (Bunsen's), in use on the same lines, had to be taken down and the zincs and cokes cleaned as often as once a week, and the fluid drawn off and thrown away every day.

Fig. 3 is a smaller sized carbon battery, somewhat modified, there being but one porous cell. All these batteries have close-fitting covers.

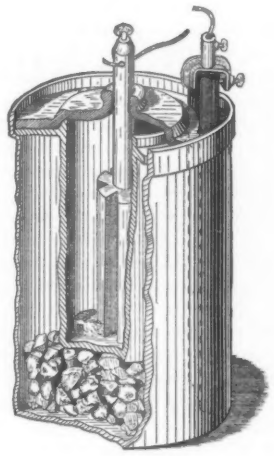


FIG. 3.

Persons wanting further information concerning these batteries will find the advertisement of the company on another page.

At the Antwerp Universal Exhibition Van Rysselberghe gave a practical solution of the possibility of sending a telegraphic and telephonic message over the same wire at the same time. The transmission and receipt of the messages were effected by the usual instruments over ordinary telegraph wire.

Ocean Telegraphy.

How cables are worked now claims our attention. I have endeavored to lead on my companion by an easy road to the main principles involved in telegraphy. I have also endeavored to introduce to his notice the construction of the apparatus, and the purposes for which it is used. He will remember the principles of action in the galvanometer, the electro-magnet, the construction and object of condensers; he will readily understand the nature of reversals of current, and the objects of a reversing key; and, therefore, he will be prepared to follow, without any further minute description, any explanations that may be made involving the use of these various principles of action and pieces of apparatus when they are merely mentioned by name.

Before I describe the modern system of working, it may, for the sake of contrast, be profitable to take a glance at the method used to work the Atlantic telegraph cable during the short period of its life in 1858, and by means of which the 129 messages were sent from Valentia to Newfoundland, and 271 messages from Newfoundland to Valentia, although the cable was never opened to the public.

From a publication "by order of the directors" of the Atlantic Telegraph Company in 1857, I gather a few particulars respecting the proposed means to be used for working the cable when laid. "When the Atlantic cable is in position at the bottom of the sea, telegraphic signals will be transmitted through it by induced magneto-electric currents, on account of the superior velocity this kind of electricity possesses over the voltaic stream. These currents will be called forth by a somewhat complicated agency, the primary element in which will be a voltaic combination of a very novel and ingenious kind." Ten capacious cells, on the Smee principle, consisting of platinized silver and amalgamated zinc plates, presenting "two thousand square inches of excitable surface to the exciting liquid," and "of exceeding power," were to be used for the primary circuit of the induction coils. "In one experiment tried to determine the heating capability of these ten cells, half an inch of bar or core of soft iron, the iron bar itself being inclosed in a sheathing of tolerably thick sheet gutta-percha, with deep flanges moulded on the sheath to divide the coiled wire into segments, so that a more perfect separation and insulation may be maintained * * * Several miles of sheathed wire of the comparatively fine No. 20 gauge are wound tightly round the core That is the secondary, passive, or to-be excited coil. This coil is covered by a layer of gutta-percha, and round this a mile and a half of sheathed wire of the comparatively thick No. 14 gauge is wound, arranged in twenty-four short lengths. That is a primary, inducing, or generating coil. The thick primary coil is placed in circuit between the poles of the voltaic battery, and receives the voltaic current when signals are to be made. This arrangement is adopted because it enables the magnet to act with increased advantage upon the wire it has to make active through induction. If the transmission coil were outside the generating coil, the magnet would have to act upon the former through the latter."

A delicate relay was contrived for the receiving instruments, composed of an electro-magnet, round whose coils the arriving current circulated, acting upon a small permanent horse-shoe magnet pivoted between the poles, making and breaking a local battery circuit through a Morse receiver. The dot and dash alphabet was to be used.

"When a message is sent across the Atlantic, the crank handle of the mighty battery will be worked backward and forward, making its contacts instantaneous or prolonged; when they are instantaneous, dots will be formed on the paper ribbon by the recording style at the other side of the Atlantic; when they are protracted, dashes will be traced there."

Such was the apparatus designed for working the Atlantic telegraph in 1857. When the cable was laid in 1858, these induction

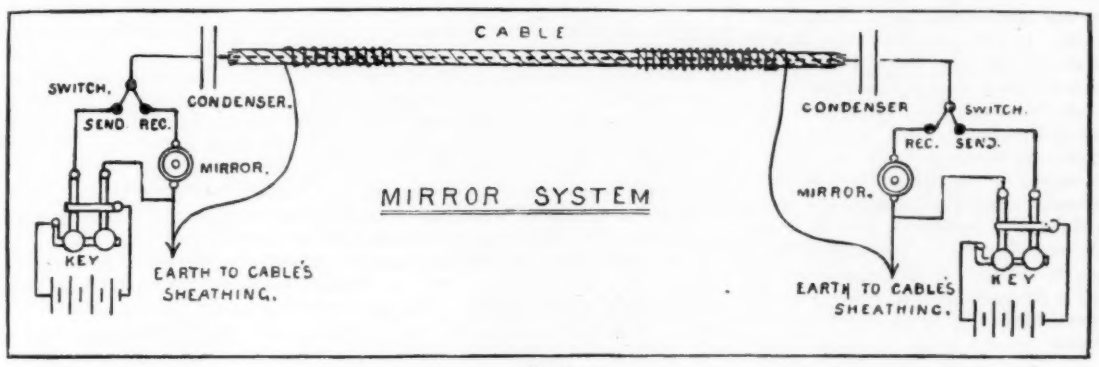


Fig. 1.

coils were used for signaling; and after all the mechanical contrivances for recording signals had failed, owing to the imperfections of the cable, the sensitive mirror galvanometer of Professor Thomson was enabled to carry on the work for some time longer. The messages were recorded then by manual keying upon a local circuit, the operator watching the motions of the reflected ray, and regulating his contacts in accordance with the duration of the deflections. This is called a "human relay."

With regard to the speed obtained through this cable, I will quote a few extracts from authentic sources:

Professor Thomson (now Sir William), on June 8, 1859, at a meeting of the shareholders of the Atlantic Telegraph Company, said:

"The first Atlantic cable in a failing state—in such a state indeed, as rendered it scarcely possible to transmit messages at all—recorded two words per minute with the most complete distinctness; the cable at that time, too, suffering so much from loss of insulation that it was impossible to get a signal recorded through it at all by any ordinary instruments. The results of these messages recorded, by hand and not by relay, are specimens of telegraphing as clear as can possibly be shown upon any telegraphic line whatever, whether long or short. I appeal to the recorded telegrams in the company's office in Old Broad Street at the present time, of the important message from the President of the United States to Queen Victoria as a proof of what I say."

The directors of the Atlantic Telegraph Company, in their report dated March 19, 1861, said that "the cable, imperfect as were both itself and the apparatus applied to it, was worked at the rate of three words a minute." The chairman, addressing a meeting on December 15, 1858, about three months after the failure of the cable, remarked, with regard to ocean cables: "We cannot disguise from ourselves that there is still considerable difficulty and mystery in the management of that extraordinary agent electricity when applied to great lines, but that all these difficulties will be overcome by science no man of real learning for a moment doubts. To my mind, one of the most discouraging circumstances in connection with our experiments was that the recording of the instruments at Valentia was so slow as to make it doubtful whether it would ever be sufficiently rapid to enable us to earn much profit, but a great advance has been made in that respect. Every day new inventions are coming out, the ingenuity of man is turned to the subject, and day by day the most intellectual men, both in England and America, are submitting to us instruments of a kind greatly calculated to improve the means of recording messages. These circumstances ought to give us great encouragement as to the probability of making our undertaking more efficient and more profitable than it ever promised to be before."

Between that date and the completion of the 1865 and 1866 cables in the year 1866, inventions were multiplied, and great improvements had been effected in the manufacture of cables and in the apparatus for testing them during their manufacture, and for working them after they were laid. The mirror galvanometer was, *par excellence*, the proper receiving instrument, both on account of its great simplicity and its extreme sensitiveness and effectiveness for registering very feeble currents. The adaptation of condensers for signaling purposes by Mr. C. F. Varley was another vast stride towards rapid signaling and the elimination of the effects of earth currents, and they have ever since been universally adopted on long cables.

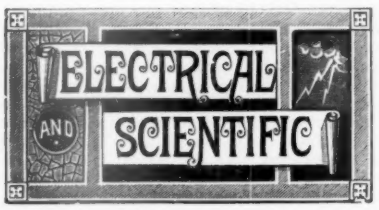
The apparatus necessary for working an ocean cable by the "mirror" system is very simple, and consists of a battery of low power—seldom exceeding 20 volts per 2,000 miles—a reversing key, a switch to change from send to receive, condensers of the required capacity, and a mirror galvanometer, with its lamps, lens and scale upon which the reflected ray of light is thrown to render the motions of the mirror (attached to the minute magnet within the coil of wire) visible.

The object of the reversing key is to be able to send from the battery either positive or negative currents at will. It is furnished with two tappers for this purpose, worked by the fingers; the left-hand key (or tapper) in the diagram (Fig. 1) sends, when depressed, a positive current from the key, the negative pole being put to earth *via* the bridge of the key. This earth should in all cases be made by soldering a wire to the sheathing of the cable to be worked. If you cannot bring the cable itself to your apparatus, you must take a wire from your apparatus to that for this purpose, if you wish to get satisfactory work out of the cable, especially so if more than one cable is to be worked from the same office.

The switch merely alters the connection from line to key, to line to mirror galvanometer, and *vice versa*, as required for either sending or receiving.

Beyond the switch, and between it and the cable, is placed the working condenser, the best capacity of which for any given cable can be determined by experiment, and thereafter remain constant. If it be desired to send into the cable direct, and to receive only through the condenser, then it must be removed from where it is placed in the diagram and put between receiver and mirror, or it may be placed between mirror and earth.

With the condenser as shown in the diagram, when the left key is depressed and a positive signal sent, it reaches the key side of the condenser as positive, the opposite plate of the condenser is by induction rendered negative, positive being repelled to the farther end of the cable in the form of a current rendering the cable side of the distant condenser positive. The opposite plate of this is made negative by induction, while the positive is driven by repulsion through the mirror galvanometer to earth, and therefore registers upon the galvanometer a current similar to that which leaves the battery at the sending station. The other (right hand) then sends a negative current, and, after going through the above process, conversely registers a negative current at the receiving end of the cable. By reversals—left for dots and right for dashes—the alphabet is formed.—*The Telegraphist.*



* * An inventor of Parkersburg, W. Va., is reported to have discovered a substance that is as impervious and durable as glass, and like it a non-conductor of electricity and useful for many purposes. It cannot be broken by ordinary means, acids have no effect upon it, and it can be used as a substitute for india-rubber.

* * A Paris electrician makes ornaments of imitation diamonds and other gems and illuminates them from the back by means of small electric lamps, the battery for which can be carried in the pocket. This ingenious device will give the humblest of us a chance to become hotel clerks, or horse doctors, without waiting for the death of a rich uncle.

* * If we expose, says O. Decharme in the *Comptes Rendus*, a plate of copper to the flame of a spirit lamp or of a Bunsen burner, or better, to the fixed and narrow jet of an enameler's lamp, there are produced upon metal iridescent coronæ around the heated point. If the experiment is well managed there are obtained fixed colored rings, apparently unalterable, in the air. These thermic rings are quite similar to the electro-chemical rings of Nobili; like them they follow one upon another, and are propagated in waves. In both cases the colors succeed each other in the same order, which is that of Newton's rings as seen by transmission. Multiple thermic rings may be produced by means of drums surmounted by two, three, four, etc., gas burners. These same pieces serve equally for the production of the electro-chemical rings by fixing in the fine openings of the tubes needles of steel of equal length for each system. The thermic rings, simple or multiple, approximate the more closely to the corresponding electro-chemical rings as the jets of flame are feebler and less oxidizing.

* * *Engineering and Mining Journal* states that at the works at Oker, in Germany, there are in operation five machines, C_1, by Siemens and Halske, of Berlin, each machine being connected to 12 depositing baths. Each machine is driven by water-power of four to five horse-power, and deposits about 300 kilos. of copper per day. At the North German Refining Works, in Hamburg, six Gramme machines (No. 1), and one Wohlwill machine are working, precipitating 2,500 kilos. of copper per day. Hilarion Roux, at Marseilles, works with a No. 1 Gramme machine connected with 40 baths, giving 900 square meters of anode surface; the cathodes being 5 cm. from the anodes, and 0.5 mm. thick. The machine makes 850 revolutions per minute, consumes 250 kilos. of coal per day, and deposits 250 kilos. of refined copper, with 8 volts 30 amperes. It is understood that in this country the electrolytic process of working copper is coming more and more into favor, especially for argentiferous copper materials, and that recently in the Swansea neighborhood new plants have been erected, and old ones extended. But details of the mode of working, and results obtained, have, so far, not transpired, beyond vague generalities.

—— The Commissioners of Charities and Correction, have made a contract with the Edison Electric Light Company to light the buildings under their charge on Ward's Island. The plant is to cost $1,300.

—— The Brush Company has contracted with the city of New Orleans for one year to furnish 113 electric lights of 2,000 candle power each, equivalent to 226,000, said lights to burn every night, commencing Jan. 1, 1885, and ending Dec. 31, 1885, for the sum of $16,019.56.

* * Among the questions most frequently asked of inspectors when making their ordinary visits, says the *Locomotive*, are the following, which are of such general interest to engineers as to warrant publication:

1st—How much water per pound of coal should be made into steam at 60 pounds pressure per square inch with 60-inch tubular boilers properly made, well set, and carefully fired?

Under the above conditions, from 8 to 10 pounds, dependent somewhat, of course, upon the quality of the coal and the temperature of the feed water.

2d—How much more coal per pound of water does it take to carry 80 pounds per square inch than it does to carry 60 pounds per square inch?

This question could, with more propriety, be put as follows: How much more heat does it take to make a pound of steam at 80 pounds pressure per square inch than it does to make a pound at 60 pounds per square inch?

Practically, no more coal will be required; theoretically, about 0.4 of one per cent., or about 1.250 part more.

3d—Do you get enough better results from steam of 80 pounds per square inch than you do from steam 60 pounds per square inch to pay the extra wear and tear of boiler and engine?

Depends entirely upon conditions. If you can make use of steam of 80 pounds pressure, it pays to use it; there are conditions, however, where 60 pounds, or even less, would be decidedly more economical.

4th—How much more heat do you get from pipes carrying 60 pounds pressure than from pipes carrying 10 pounds pressure?

Two and one-tenth per cent. more heat will be given out per pound condensed from steam of 60 pounds pressure than from steam of 10 pounds pressure, in falling from temperature due to the respective pressures to 212° Fahr.

5th—What proportion of direct heating surface to the volume of a fairly protected room is required to maintain the temperature of the room at 60° Fahr. in buildings heated by steam?

From 1.75 to 1.250, according to size and exposure of room.

6th—How much is a given amount of steam reduced in bulk by compressing it from 60 pounds per square inch to 80 pounds per square inch?

About 20 per cent.

* * The long-sought process by which aluminum metal may be cheaply produced for use in the mechanic arts is at last said to have been fonnd. William Frishmuth, a chemist of Philadelphia and a pupil of Wohler, who discovered the metal, is the discoverer. He has been working for twenty-eight years to solve the problem, and has now secured basic patents throughout most of the civilized world for his process, which when worked in a large plant will turn out practically unlimited quantities of the metal at a cost of about $1.25 a pound, or one-twelfth the present price. Aluminum is made only from its oxide, alumina. This is found everywhere, there being more in the ground than there is of iron. The process heretofore employed to obtain the aluminium from the oxide has been by treating its chloride with metallic sodium as a reducing agent. The great difficulties experienced, however, in handling this dangerous material and its very great cost—about $3 per pound—have made the process too difficult and expensive. In the process employed by Frishmuth, instead of using metallic sodium he uses a vapor produced or generated in suitable retorts from a mixture of carbonate of sodium or other suitable compounds of sodium and carbon, or some other reducing agent. This sodium vapor is made to react upon the aluminous materials, the product being the metal aluminium. In the old process, known as the De Ville, to produce twenty pounds of aluminium, fifty pounds of metallic sodium, costing not less than $150, are required. By that of Frishmuth, 115 pounds of carbonate of sodium, costing one cent per pound, are used. The uses of the metal are almost illimitable. Being only about one-quarter the weight of other metals, it will be substituted for these in countless ways. For lightning-rods, telegraph and electric-light wires it will come into use, as, with the exception of silver, it is the best conductor of electricity known. It is non-corrosive and will not tarnish, and is expected to eventually supplant the other metals for domestic uses, and it is also anticipated that, owing to these qualities, it will supersede the use of brass. It will also be used for subsidiary coins. Specimens of these have been made, and after handling for months show no signs of wear, and are as bright as the day they were struck. As an alloy, however, it will prove of the greatest value, especially when combined with silver and copper, giving to these metals its non-corrosive and non-tarnishing qualities, and greatly increasing their tensile strength. As showing what has been done at the Philadelphia works, a handsome collection of the metal in bulk and articles manufactured from it and its alloys has been prepared and sent to New Orleans for exhibition at the coming exposition.

Electricity as a Motor.

INTERESTING HISTORY OF A SERIES OF EXPERIMENTS—GRADUAL DEVELOPMENT OF A GREAT IDEA—TOLD BY ONE OF THE OLDEST AND ABLEST OF AMERICAN ELECTRICIANS.

Cyrus W. Field, Esq.

My Dear Sir,—Now that the application of electricity to the elevated roads is agitated, it occurs to me that it may be interesting to glance at some of the steps in the progress of discovery and invention which made electro-locomotion possible in 1850, and practicable in 1883–4. It was not until 1819-20 that Oersted, of Copenhagen, discovered that, if a wire carried a current of electricity from south to north over a magnetic needle, it caused the north end of the needle to be deflected towards the west, and also, if the current passed from north to south under the needle, the deflection of the north end of the needle was still towards the west.

It was not long before Schweiger carried the wire and current several times over and under the needle, and thus invented the galvanometer. Before 1826 Sturgeon had wound a wire several times around a bar of soft iron, and, when a current of electricity was sent through the coiled wire spiral, it made a temporary magnet of the iron bar, which magnetism remained as long as the current was flowing. Soon after, as early as 1831, Faraday discovered the principal facts of magneto-electric induction, and thus made the magneto-electric machine possible in the hands of Pixii in 1832. The Daniell's and the Grove's batteries soon after appeared, and in 1839 Jacobi, at St. Petersburg, constructed a boat, which he propelled upon the River Neva with a two horse-power electro magnetic engine, actuated by a Grove battery, which had in it twenty square feet of platinum surface.

In 1840 Davenport and Cook, of Vermont, constructed a walking-beam engine, with which they drove a printing press, using a zinc and copper battery, with a solution of blue vitriol as the exciting liquid.

In 1842 Davidson, of Scotland, constructed a five-ton electric locomotive, which he propelled at the rate of four miles per hour with seventy eight pairs of zinc and iron in sulphuric acid solution, the plates being thirteen inches square.

In 1844 Channing conceived the idea of substituting an electro-magnet in place of the permanent steel magnet in the magneto-electric machine of Pixii, and the further idea of using this electro-magneto electric machine to excite the field magnets of a still larger electro-magneto electric machine.

(This idea was subsequently, in 1863–6, further elaborated by Henry Wilde, of Manchester, England.)

In 1847 I constructed and exhibited in public an electro-magnetic locomotive, and with forty-eight pint-cup cells of Grove nitric acid battery drew a little car carrying two passengers on a track a foot and a half wide.

In 1850 Page, of Washington, constructed an electro-magnetic engine of sixteen horse-power, and with a hundred cells of Grove nitric acid battery, each having platinum plates eleven inches square, he propelled a car carrying a dozen or more passengers on the Washington and Baltimore Railroad at the rate of nineteen miles per hour.

In 1851 Thomas Hall, of Boston (then at work for Daniel Davis) constructed, and later exhibited at the Charitable Mechanics' Fair in Boston, a small electric locomotive which took its current from a stationary battery by means of the rails and wheel, as the following extract from a letter written to me by him, November 25, will show: "In the year 1851, when I was at work for Daniel Davis, I made a small electric locomotive, which ran on a straight track about twenty feet long. The wheels were insulated, and the electricity was conveyed to the engine by means of the rails from two Grove batteries. The cut-off was in the engine, and worked automatically or by hand, so that when the engine reached the end of the track the switch reversed the engine, and it went back to the starting point. In 1860 I exhibited in the Mechanics' Fair a small locomotive called the Volta, very finely made and finished, which ran on a circular track about eight feet in diameter. The current was conducted to the insulated wheels from two Grove batteries by means of the rails. I have a part of one of these engines on hand now, and photographs of the Volta; also woodcuts of the first ones, which were published in a catalogue between 1851 and 1860."

I asked Mr. Hall's permission to publish his letter, and in reply he says: "Shall be glad to have you publish the facts as I have stated them to you, and shall be obliged to you for doing it. You know they are facts as well as I do."

These four engines, therefore, of Davidson, Farmer, Page and Hall could be started and stopped, sent forward or backward, at the pleasure of the engineer.

In 1859 I conceived of the self-exciting dynamo, which I constructed in 1866, and which was also conceived of by Wheatstone, Siemens and Ladd in 1867 and by Gramme in 1871, so that by 1871 cheap electricity became possible, and nothing more was needed except to substitute the dynamo machine for the galvanic battery to make electro-locomotion both possible and cheap, and yet the invention slumbers on for a decade or more.

Now, in 1884, a host of inventors, by simply substituting the now well-known dynamo for the more expensive and troublesome acid battery, appear to be just on the eve of bringing to blossom and fruitage those buds of promise after their long forty years of germination, because there was then no demand, no elevated roads, and so they came not forth.

There are two principal methods of propelling an electric locomotive: 1st. The engine carries its source of electricity, such as a galvanic battery, as did Davidson's, Farmer's and Page's. 2d It is picked up from a stationary source by means of the wheels and rails, as did Hall's.

In the later days, since the advent of the storage battery, the supply of electricity can be economically carried on a tender, and it is worthy of very patient and long experimental inquiry, which method is the cheaper—to lay a third rail to carry the current to the locomotive, or to charge the storage battery, place it on a tender, and attach it to the locomotive.

Respectfully yours,

Moses G. Farmer.

The ordinary receipts of the United States for the last fiscal year were $348,519,869.92. Of this amount 56 per cent. came from customs duties, 35 per cent. from internal revenue, and the rest from various sources. The total ordinary expenditures for the year, exclusive of the sinking fund, were $244,126,244 33. Of this amount there was spent, in round numbers, for the army, $39,500,000; for the navy, $17,000,000; for pensions, $55,500,000; for civil expenses, $22,000,000; for miscellaneous expenses, including public buildings and collecting the revenue, $44,000,000, and for interest on the public debt, $55,000,000. Foreign intercourse cost only $1,260,766.

(*Concluded from page 3.*)

to lamp is involved, whilst additional expense of the fine wire is very slight.

If the switch of either lamp is turned on while the branch circuit is open, the cut-out circuit is broken at that switch and the branch cut-out magnet no longer attracts the armature, which accordingly drops and closes the branch circuit. The branch corresponding to the switch turned on is therefore, thrown in circuit and lights up.

All other series or branch circuits are identical with the above described series and are connected with the mains at any convenient point.

It is obviously desirable that those lamps which are least likely to be needed continuously should be placed in the same series, and thus avoid waste of energy when they are cut out.

A general perspective view of one series of four cut-out boxes with switches and branch cut-out corresponding in all respects to the diagram cut above, is shown in Fig. 5 All of these appliances may, of course, be put anywhere; in the cellar, garret or wherever it may be most convenient to have them out of the way. They need not necessarily be grouped together, and the switches are usually placed on the wall near the lamps. In places where the lamps would be burned continuously, the cut-out circuit could be dispensed with, and ordinary multiple series switches used; or, for that matter, the switches could also be done away with.

The Weston 125 candle-power lamps are particularly adapted for street lighting. Fig. 8 shows a street lamp post fitted with such a lamp and a special reflector. Several of these were exhibited at the electrical exhibition. For street lighting by the multiple series system, the rheostat and cut-out devices are placed in the tops of the reflectors, care, of course, being taken to secure proper ventilation.

The many advantages of the multiple series system in connection with large incandescent lamps can scarcely be over-estimated. Arc lamps in use may be replaced by large incandescent lights without any change in dynamo or leads.

The Weston 20-light dynamo for arc lighting has a capacity of something over 650 volts and 25 amperes, though it is not ordinarily run at its limit. Now four of the 125 candle-power lamps in series would require 640 volts electro-motive force, and ten such series would require 23 amperes of current. In other words, 40 of the large lamps may be burned in multiple series from an ordinary 20 arc-light machine, and leave, besides, a considerable margin for loss of potential in the leads.

For small installations 20 lamps connected in series of two are supplied from a 10 arc-light dynamo and for large installations a 30 arc light dynamo supplies current for 60 lamps in series of 6 and a 40 light dynamo for 80 in series of 8. In all cases the leads used for the arc system are of proper capacity as the current remains substantially the same as when arc lights are used.

Part of the large lamps used at the exhibition were run by this multiple series system and we are informed that it worked admirably without attention during the whole time of the exhibition.

In comparing this system with the arc system it is somewhat difficult to determine the question of relative economy. The so-called 2,000 candle-power arc lights require from three-fourths of a horse-power to a horse-power for working it and as ordinarily run has probably an actual illuminating power of from 350 to 500 candles, taking the average of photometrical measurements in all directions. As is well known, the nominal illuminating power was determined, when this standard was first introduced, by what is known as "French measurement," that is by throwing the carbons out of line so as 'to project nearly all the light in one direction and taking photometrical measurements on the maximum side only, which would account in great measure for the large discrepancy between the nominal illuminating power and the real illuminating power.

With the Weston 125-candle lamp, as we have seen above, about 250 candles are produced per horse-power, or approximately one half the absolute amount of light given by the arc system for the same expenditure of power. As against this there is no consumption of carbons in the incandescent system and the cost of attendance is very much less than in the arc system, since the daily renewal of carbons is obviated and the incandescent system also requires much less general attention than the arc. In addition to this the incandescent lamp has a considerable advantage in distribution and utilization of the light produced. Much of the light from an arc lamp is dissipated in directions where its effects are not useful, owing to the impossibility of properly adjusting reflectors to the constantly shifting arc, and for many purposes the arc lamp is too large a unit for effective distribution. Taking all these things into consideration it is by no means impossible that a comparison of cost of production and *useful* illuminating effects will show a balance of economy in favor of the large incandescent lamp. If this is realized, or if the difference in economy is not large, there can be no doubt that such lamps will prove a very formidable competitor to the arc light, as the incandescent system has unquestionably a great advantage in the superior quality and absoltute steadiness of the light.

Whether this system is destined to supplant the arc system or not, it seems certain that it will develop a field of its own of no small proportions, in which it will have great advantages over both the arc system and the ordinary incandescent system.

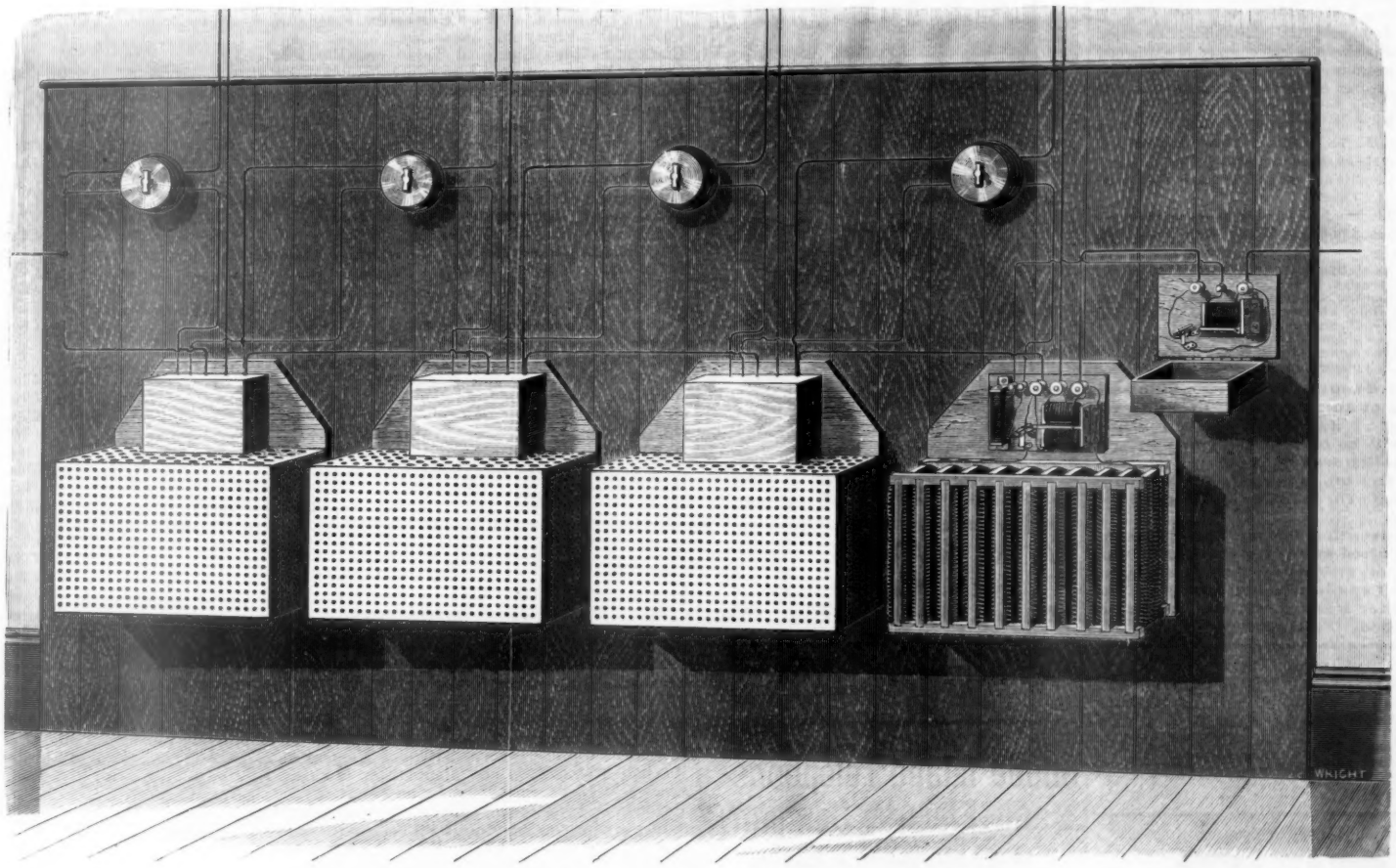


FIG. 5.—RHEOSTATS, CUT-OUTS AND SWITCHES, WESTON MULTIPLE SERIES SYSTEM.

Organizing the American Electric Railway Company.

The fifth of the series of meetings for the consolidation of the electric railway companies in the United States was held at the residence of Mr. Cyrus W. Field, Gramercy Park, last week. The Daft Company was not represented, and at the next meeting no representatives of companies which have not accepted the following agreement will be admitted:

THE CONDITION OF ENTRANCE.

After discussion, it was decided that all the parties who are to come into the American Electric Railway Company must agree to transfer to the company all their patents and inventions for electrical propulsion on railways in the United States, as a condition precedent to participating in the advantages of this arrangement, they to be compensated by participation in the stock reserved for patents and inventions, in the proportion fixed by the arbitrators.

Sir William Thomson, of Glasgow University; Prof. Charles R. Cross, of the Massachusetts Institute of Technology; and President Harris, of the Northern Pacific Railway, have accepted invitations to be members of the Expert Commission to test the rival electric motors on the Second Avenue elevated railway, and apportion the stock of the new company among the companies consolidating, according to the value of their respective motor patents; and it is believed that President Roberts, of the Pennsylvania Railway, and President Rutter, of the New York Central Railway, will also accept. It is understood that the commission will be empowered to employ expert electricians and practical mechanical engineers to conduct the test, under its direction, and its members will render a verdict upon the results of the experiments.

TO COMPLETE THE ORGANIZATION.

The organization of the American Electric Railway Company is to be completed at a meeting to be held at the residence of Mr. Cyrus W. Field, on Forefathers' Day, next Monday evening. Messrs. David Dudley Field and E. N. Dickerson, Sr., have been appointed to prepare the necessary papers, and it is expected that the contracts will be signed in the same room and at the same table where the contract for the first Atlantic cable was signed, on March 10, 1854.

Among the plans under consideration for the elevated railways is one to place an electric motor underneath each car, so that the length of trains can be regulated according to the traffic, and the intervals between trains be almost as short during the middle of the day and of the night as during commission hours.

The electric lights in San Jose, Cal., is death on birds, especially on rainy and cloudy nights, when they seem to lose their heads and pitch into the light. One night forty-eight birds fell dead or wounded by striking the irons of the main tower, and on the preceding night two ducks fell victims to the electric glare.

The completion of the new Mackay Bennett cable doubtless marks a decrease in message rates to Europe. It should also assure American readers a larger and, in some degree, better supply of foreign news than is now given them. The present service is excellent considering all things, but lower rates should bring fuller despatches. Keen as American interest in foreign affairs now is, it can hardly fail to be stimulated by these increased opportunities for information.

ELECTRICAL PATENTS.

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING DECEMBER 16, 1884.

309,244 Method of making telegraph cables William R. Patterson, Chicago, Ill., assignor to the Western Electric Company, same place.

309,245 Means for ventilating test stations of underground cables; William R. Patterson, Chicago, Ill., assignor to the Western Electric Company, same place.

309,246 Electric light conductors; William R. Patterson, Chicago, Ill., assignor to the Western Electric Light Company, same place.

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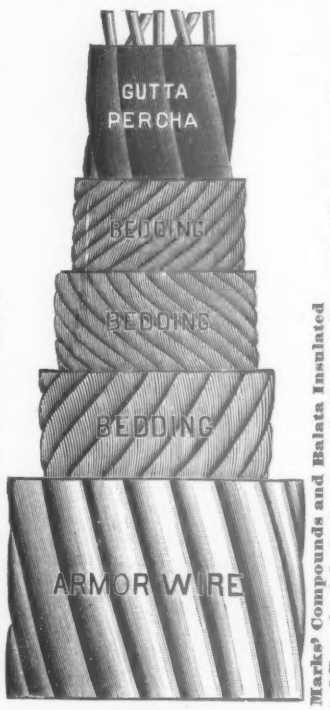

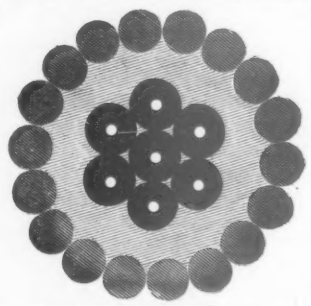

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